

## CLAIMS

What is claimed is:

- 1 1. A method comprising:  
2 receiving a new policy tree at a network element in a network, wherein the  
3 network element stores a current policy tree of classes for quality of service of packets  
4 being processed by the network element;  
5 comparing the classes of the current policy tree with the classes of the new  
6 policy tree; and  
7 selectively deleting classes of the current policy tree based on the comparison of  
8 the classes.
- 1 2. The method of claim 1, wherein the classes of the current policy tree and the  
2 classes of the new policy tree comprise leaf classes and non-leaf classes.
- 1 3. The method of claim 2, wherein the comparing of the classes of the current  
2 policy tree with the classes of the new policy tree comprises:  
3 for the current policy tree and the new policy tree, merging, into a set of  
4 classification rules of the leaf classes, classification rules of non-leaf classes that are  
5 ancestors of the leaf classes;  
6 identifying a leaf class in the current policy tree as identical to a leaf class in the  
7 new policy tree upon determining that the set of classification rules of the leaf class in  
8 the current policy tree is equal to the set of classification rules of the leaf class in the  
9 new policy tree;

10 identifying a non-leaf class in the current policy tree as identical to a non-leaf  
11 class in the new policy tree upon determining that the non-leaf class in the current  
12 policy tree and the non-leaf class in the new policy tree share a greatest number of  
13 equivalent descendant leaf classes; and  
14 marking the classes of the current policy tree and the new policy tree as added,  
15 deleted, modified or unchanged based on the identifying of the identical leaf and non-  
16 leaf classes in the current policy tree and new policy tree.

1 4. The method of claim 3, wherein the selectively deleting classes of the current  
2 policy tree comprises deleting a class of the current policy tree upon determining that a  
3 set of classification rules of the class of the current policy tree is different than a set of  
4 classification rules of a corresponding class of the second policy tree.

1 5. The method of claim 4, wherein each class in the current and new policy tree is  
2 positioned at a level in the current and new policy tree and wherein the selectively  
3 deleting classes of the current policy tree comprises deleting a leaf class of the current  
4 policy tree upon determining that that the leaf class of the current policy tree is not  
5 positioned at a same level as a leaf class of the new policy tree.

1 6. The method of claim 3, wherein the selectively deleting classes of the current  
2 policy tree comprises selectively deleting at least one leaf class of the current policy  
3 tree .

1 7. The method of claim 3, wherein the selectively deleting classes of the current  
2 policy tree comprises selectively deleting at least one non-leaf class of the current  
3 policy tree .

1 8. The method of claim 3, wherein a class having a parent class further includes all  
2 classification rules included in the parent class.

1 9. The method of claim 3, wherein each class is positioned at a level in a policy  
2 tree and wherein a leaf class of the current policy tree is identical to a leaf class of the  
3 new policy tree only if the leaf class of the current policy tree and the leaf class of the  
4 new policy tree are positioned at an equal level.

1 10. The method of claim 3, wherein each leaf class in the current policy tree and the  
2 new policy tree is reciprocally linked to an associated path of non-leaf classes in the  
3 current policy tree and new policy tree, respectively, and wherein the selectively  
4 deleting the classes of the current policy tree comprises deleting each leaf class in the  
5 current policy tree upon determining that the associated path of non-leaf classes in the  
6 current policy tree is different from the path of non-leaf classes in the new policy tree  
7 for a leaf class.

1 11. The method of claim 3, wherein each class in the current and new policy tree is  
2 positioned at a level in the current and new policy tree, wherein each leaf class in the  
3 current policy tree and the new policy tree is reciprocally linked to an associated path  
4 of non-leaf classes in the current policy tree and new policy tree, respectively, and  
5 wherein the selectively deleting classes of the current policy tree comprises deleting a

6 leaf class of the current policy tree upon determining that the associated path of non-  
7 leaf classes linked to the leaf class of the current policy tree includes a non-leaf class  
8 positioned at a different level than a corresponding non-leaf class included in the  
9 associated path of non-leaf classes linked to the leaf class of the new policy tree.

1 12. The method of claim 11, wherein the selectively deleting classes of the current  
2 policy tree comprises deleting a leaf class of the current policy tree upon determining  
3 that all ancestors of the leaf class of the current policy tree and corresponding ancestors  
4 of the leaf of the new policy tree have fewer identical descendant classes than those had  
5 by a class of the current policy tree and a class of the new policy tree positioned at the  
6 same level as the ancestors of the leaf class of the current policy tree and the ancestors  
7 of the leaf class of the new policy tree.

1 13. A method comprising:  
2 comparing a first policy tree of nodes with a second policy tree of nodes,  
3 wherein each node is reciprocally associated with a class of network packets, each class  
4 including a set of rules; and  
5 selectively adding classes of the second policy tree to the first policy tree based  
6 on the comparison of the classes.

1 14. The method of claim 13, wherein the selectively adding classes of the second  
2 policy tree to the first policy tree comprises adding a node of the second policy tree to  
3 the first policy tree upon determining that the set of rules associated with the node of  
4 the first policy tree is different that the set of rules associated with the corresponding  
5 node of the second policy tree.

1 15. The method of claim 14, wherein each node in the first and second policy tree is  
 2 positioned at a level in the first and second policy tree and wherein the selectively  
 3 adding classes of the second policy tree to the first policy tree comprises or adding a  
 4 leaf node of the second policy tree to the first policy tree upon determining that that the  
 5 leaf node of the first policy tree is not positioned at a same level as a leaf node of the  
 6 second policy tree.

1 16. The method of claim 13, wherein the selectively adding classes of the second  
 2 policy tree to the first policy tree comprises selectively adding a leaf node of the second  
 3 policy tree to the first policy tree.

1 17. The method of claim 13, wherein the selectively adding classes of the second  
 2 policy tree to the first policy tree comprises selectively adding a non-leaf node of the  
 3 second policy tree to the first policy tree.

1 18. The method of claim 13, wherein a class associated with a node having a parent  
 2 node further includes all rules included in a class associated with the parent node.

1 19. The method of claim 13, wherein each node is positioned at a level in the first  
 2 and second policy tree of nodes and wherein a first leaf class is identical to a second  
 3 leaf class only if a leaf node associated with the first leaf class and a leaf node  
 4 associated with the second leaf class are positioned at an equal level.

1 20. The method of claim 13, wherein each leaf node in the first policy tree of nodes  
 2 and the second policy tree of nodes is reciprocally linked to an associated path of non-

3 leaf nodes in the first policy tree of nodes and second policy tree of nodes, respectively,  
4 and wherein the selectively adding classes of the second policy tree to the first policy  
5 tree comprises adding each leaf node in the second policy tree of nodes to the first  
6 policy tree of nodes upon determining that the associated path of non-leaf nodes in the  
7 first policy tree of nodes is different from the path of non-leaf nodes in the second  
8 policy tree of nodes for a leaf node.

1 21. The method of claim 13, wherein each node is positioned at a level in the first  
2 and second policy tree of nodes, wherein each leaf node in the first policy tree of nodes  
3 and the second policy tree of nodes is reciprocally linked to an associated path of non-  
4 leaf nodes in the first policy tree of nodes and second policy tree of nodes, respectively,  
5 and wherein the selectively adding the nodes of the second policy tree to the first policy  
6 tree comprises replacing a leaf node in the first policy tree of nodes with a  
7 corresponding leaf node in the second policy tree of nodes upon determining that the  
8 associated path of non-leaf nodes linked to the leaf node of the first policy tree includes  
9 a non-leaf node positioned at a different level than a corresponding non-leaf node  
10 included in the associated path of non-leaf nodes linked to the leaf node of the second  
11 policy tree.

1 22. The method of claim 21, wherein the selectively adding the nodes of the second  
2 policy tree to the first policy tree comprises adding a leaf node in the second policy tree  
3 of nodes to the first policy tree of nodes upon determining that all ancestors of the leaf  
4 node of the first policy tree and corresponding ancestors of the leaf node of the second  
5 policy tree have fewer identical descendant nodes than those had by a node of the first  
6 policy tree and a node of the new policy tree positioned at the same level as the

ancestors of the leaf node of the first policy tree and the ancestors of the leaf node of the second policy tree.

23. A machine-readable medium that provides instructions, which when executed by a machine, cause said machine to perform operations comprising:

receiving a new policy tree at a network element in a network, wherein the network element stores a current policy tree of classes for quality of service of packets being processed by the network element;

comparing the classes of the current policy tree with the classes of the new policy tree; and

selectively deleting classes of the current policy tree based on the comparison of the classes.

24. The machine-readable medium of claim 23, wherein the classes of the current policy tree and the classes of the new policy tree comprise leaf classes and non-leaf classes.

25. The machine-readable medium of claim 24, wherein the comparing of the classes of the current policy tree with the classes of the new policy tree comprises:

for the current policy tree and the new policy tree, merging, into a set of classification rules of the leaf classes, classification rules of non-leaf classes that are ancestors of the leaf classes;

identifying a leaf class in the current policy tree as identical to a leaf class in the new policy tree upon determining that the set of classification rules of the leaf class in

8 the current policy tree is equal to the set of classification rules of the leaf class in the  
9 new policy tree;

10 identifying a non-leaf class in the current policy tree as identical to a non-leaf  
11 class in the new policy tree upon determining that the non-leaf class in the current  
12 policy tree and the non-leaf class in the new policy tree share a greatest number of  
13 equivalent descendant leaf classes; and

14 marking the classes of the current policy tree and the new policy tree as added,  
15 deleted, modified or unchanged based on the identifying of the identical leaf and non-  
16 leaf classes in the current policy tree and new policy tree.

1 26. The machine-readable medium of claim 25, wherein the selectively deleting  
2 classes of the current policy tree comprises deleting a class of the current policy tree  
3 upon determining that a set of classification rules of the class of the current policy tree  
4 is different than a set of classification rules of a corresponding class of the second  
5 policy tree.

1 27. The machine-readable medium of claim 26 wherein each class in the current  
2 and new policy tree is positioned at a level in the current and new policy tree and  
3 wherein the selectively deleting classes of the current policy tree comprises deleting a  
4 leaf class of the current policy tree upon determining that that the leaf class of the  
5 current policy tree is not positioned at a same level as a leaf class of the new policy  
6 tree.



1 28. The machine-readable medium of claim 25, wherein the selectively deleting  
2 classes of the current policy tree comprises selectively deleting at least one leaf class  
3 of the current policy tree .

1 29. The machine-readable medium of claim 25, wherein the selectively deleting  
2 classes of the current policy tree comprises selectively deleting at least one non-leaf  
3 class of the current policy tree .

1 30. The machine-readable medium of claim 25, wherein a class having a parent  
2 class further includes all classification rules included in the parent class.

1 31. The machine-readable medium of claim 25, wherein each class is positioned at  
2 a level in a policy tree and wherein a leaf class of the current policy tree is identical to a  
3 leaf class of the new policy tree only if the leaf class of the current policy tree and the  
4 leaf class of the new policy tree are positioned at an equal level.

1 32. The machine-readable medium of claim 25, wherein each leaf class in the  
2 current policy tree and the new policy tree is reciprocally linked to an associated path  
3 of non-leaf classes in the current policy tree and new policy tree, respectively, and  
4 wherein the selectively deleting the classes of the current policy tree comprises deleting  
5 each leaf class in the current policy tree upon determining that the associated path of  
6 non-leaf classes in the current policy tree is different from the path of non-leaf classes  
7 in the new policy tree for a leaf class.

1 33. The machine-readable medium of claim 25, wherein each class in the current  
2 and new policy tree is positioned at a level in the current and new policy tree, wherein  
3 each leaf class in the current policy tree and the new policy tree is reciprocally linked to  
4 an associated path of non-leaf classes in the current policy tree and new policy tree,  
5 respectively, and wherein the selectively deleting classes of the current policy tree  
6 comprises deleting a leaf class of the current policy tree upon determining that the  
7 associated path of non-leaf classes linked to the leaf class of the current policy tree  
8 includes a non-leaf class positioned at a different level than a corresponding non-leaf  
9 class included in the associated path of non-leaf classes linked to the leaf class of the  
10 new policy tree.

1 34. The machine-readable medium of claim 33, wherein the selectively deleting  
2 classes of the current policy tree comprises deleting a leaf class of the current policy  
3 tree upon determining that all ancestors of the leaf class of the current policy tree and  
4 corresponding ancestors of the leaf of the new policy tree have fewer identical  
5 descendant classes than those had by a class of the current policy tree and a class of the  
6 new policy tree positioned at the same level as the ancestors of the leaf class of the  
7 current policy tree and the ancestors of the leaf class of the new policy tree.

1 35. A machine-readable medium that provides instructions, which when executed  
2 by a machine, cause said machine to perform operations comprising:  
3 comparing a first policy tree of nodes with a second policy tree of nodes,  
4 wherein each node is reciprocally associated with a class of network packets, each class  
5 including a set of rules; and

6 selectively adding classes of the second policy tree to the first policy tree based  
7 on the comparison of the classes.

1 36. The machine-readable medium of claim 35, wherein the selectively adding  
2 classes of the second policy tree to the first policy tree comprises adding a node of the  
3 second policy tree to the first policy tree upon determining that the set of rules  
4 associated with the node of the first policy tree is different that the set of rules  
5 associated with the corresponding node of the second policy tree.

1 37. The machine-readable medium of claim 36, wherein each node in the first and  
2 second policy tree is positioned at a level in the first and second policy tree and wherein  
3 the selectively adding classes of the second policy tree to the first policy tree comprises  
4 or adding a leaf node of the second policy tree to the first policy tree upon determining  
5 that that the leaf node of the first policy tree is not positioned at a same level as a leaf  
6 node of the second policy tree.

1 38. The machine-readable medium of claim 35, wherein the selectively adding  
2 classes of the second policy tree to the first policy tree comprises selectively adding a  
3 leaf node of the second policy tree to the first policy tree.

1 39. The machine-readable medium of claim 35, wherein the selectively adding  
2 classes of the second policy tree to the first policy tree comprises selectively adding a  
3 non-leaf node of the second policy tree to the first policy tree.

1 40. The machine-readable medium of claim 35, wherein a class associated with a  
2 node having a parent node further includes all rules included in a class associated with  
3 the parent node.

1 41. The machine-readable medium of claim 35, wherein each node is positioned at  
2 a level in the first and second policy tree of nodes and wherein a first leaf class is  
3 identical to a second leaf class only if a leaf node associated with the first leaf class and  
4 a leaf node associated with the second leaf class are positioned at an equal level.

1 42. The machine-readable medium of claim 35, wherein each leaf node in the first  
2 policy tree of nodes and the second policy tree of nodes is reciprocally linked to an  
3 associated path of non-leaf nodes in the first policy tree of nodes and second policy tree  
4 of nodes, respectively, and wherein the selectively adding classes of the second policy  
5 tree to the first policy tree comprises adding each leaf node in the second policy tree of  
6 nodes to the first policy tree of nodes upon determining that the associated path of non-  
7 leaf nodes in the first policy tree of nodes is different from the path of non-leaf nodes in  
8 the second policy tree of nodes for a leaf node.

1 43. The machine-readable medium of claim 35, wherein each node is positioned at  
2 a level in the first and second policy tree of nodes, wherein each leaf node in the first  
3 policy tree of nodes and the second policy tree of nodes is reciprocally linked to an  
4 associated path of non-leaf nodes in the first policy tree of nodes and second policy tree  
5 of nodes, respectively, and wherein the selectively adding the nodes of the second  
6 policy tree to the first policy tree comprises replacing a leaf node in the first policy tree  
7 of nodes with a corresponding leaf node in the second policy tree of nodes upon

8 determining that the associated path of non-leaf nodes linked to the leaf node of the  
9 first policy tree includes a non-leaf node positioned at a different level than a  
10 corresponding non-leaf node included in the associated path of non-leaf nodes linked to  
11 the leaf node of the second policy tree.

1 44. The machine-readable medium of claim 43, wherein the selectively adding the  
2 nodes of the second policy tree to the first policy tree comprises adding a leaf node in  
3 the second policy tree of nodes to the first policy tree of nodes upon determining that  
4 all ancestors of the leaf node of the first policy tree and corresponding ancestors of the  
5 leaf node of the second policy tree have fewer identical descendant nodes than those  
6 had by a node of the first policy tree and a node of the new policy tree positioned at the  
7 same level as the ancestors of the leaf node of the first policy tree and the ancestors of  
8 the leaf node of the second policy tree.